Saskatchewan
Research Council

1985-86 Annual Report

87-05824/

Letter of Transmittal

February 10, 1987

TO THE HONOURABLE F.W. JOHNSON
Lieutenant Governor of the Province of Saskatchewan

MAY IT PLEASE YOUR HONOUR:

The undersigned presents herewith, for your consideration, the report of the Saskatchewan Research Council for the year ended March 31, 1986.

Respectfully submitted,

Ray Meiklejohn

Ray Meiklejohn
Minister responsible for
Saskatchewan Research Council

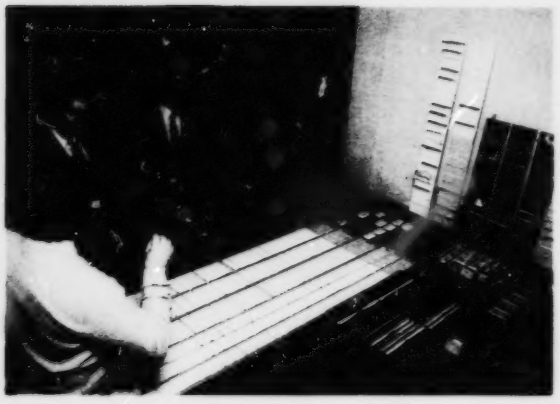
The Research Council Act

Section 21, in part, directs that:

The Council shall on or before the last day of February in each year submit to the Lieutenant Governor in Council a report of its proceedings and transactions during the next preceding calendar year, which report shall contain such particulars as the Lieutenant Governor in Council may prescribe. Every report shall be laid before the Legislative Assembly if then in session, or if it is not in session, within fifteen days after the opening of the next session.

Photo Page 1

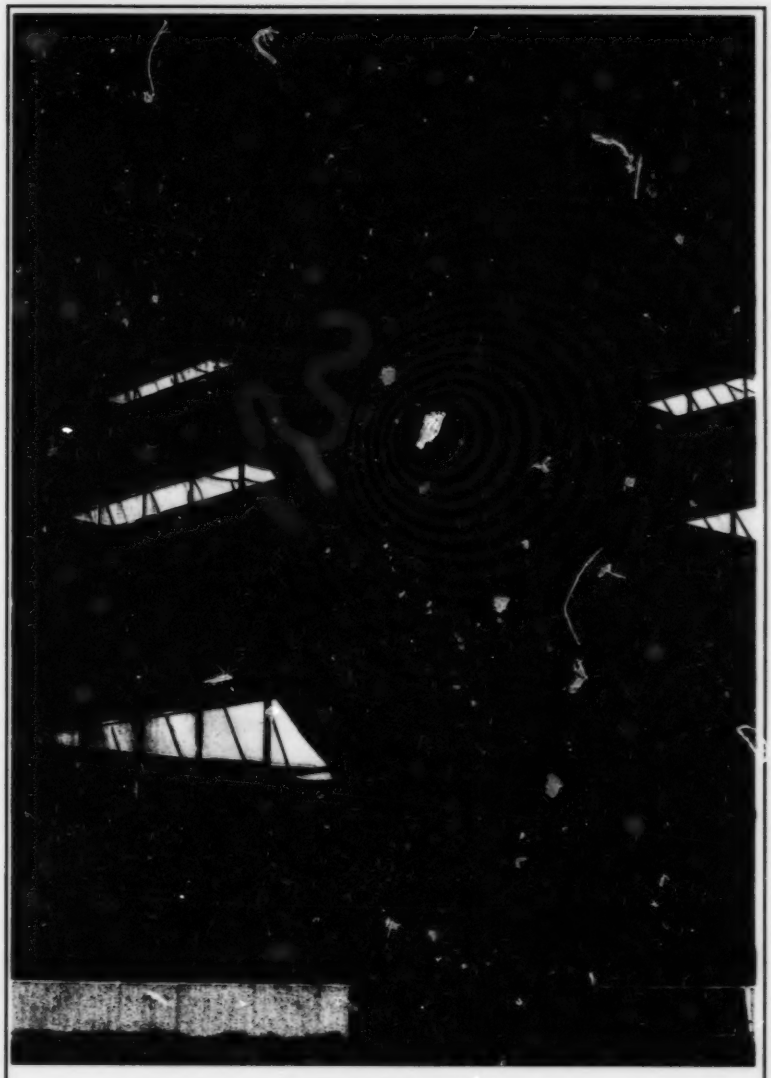
In 1985 SRC centralized its operations at Saskatoon's Innovation Place Research Park. This building houses corporate offices and laboratories. Other SRC facilities are located in Saskatoon and Regina.



The Honourable Ray Meiklejohn, Minister responsible for Saskatchewan Research Council (left rear), with Jim Hutch, SRC President (right), meets Dave Jennings (foreground) of the Buildings and Energy Technology program in SRC's Product Testing Laboratory. The test samples displayed are part of work that will develop standards for caulks and sealants in buildings.

Cover:

1. Rolf Jahren (left) and Ray Begrand sample stack gas emissions for a provincial resource industry.
2. Farming near Clavet, Saskatchewan, Keith and Cheryle Smith participate in SRC's Enerdemo program by using a variety of fuel saving measures, including minimum tillage.
3. Keith Smith, an Enerdemo program farmer-participant, uses metered bulk fuel tanks to measure fuel use for different field operations.
4. Jeff Flynn operates equipment in the Product Testing Laboratory of SRC's Buildings and Energy Technology program.
5. The SRC Petroleum Division applies expertise in heavy oil to enhanced recovery, upgrading and analysis of the resource.
6. Colleen Rickard uses a growth chamber to test acid precipitation tolerance of plants such as white spruce, aspen, wheat, canola and alfalfa.
7. Jerry Scoular operates a Mobile Emulsion Treating Unit designed and constructed at the SRC Petroleum Division.
8. Rod Bouvier (foreground) and Ken Bindle work with rainbow trout at SRC's Aquaculture Field Laboratory.
9. Muzaffer Zahri (foreground) and Wo Yuen prepare vegetation samples for testing in the Analytical Services Laboratory.

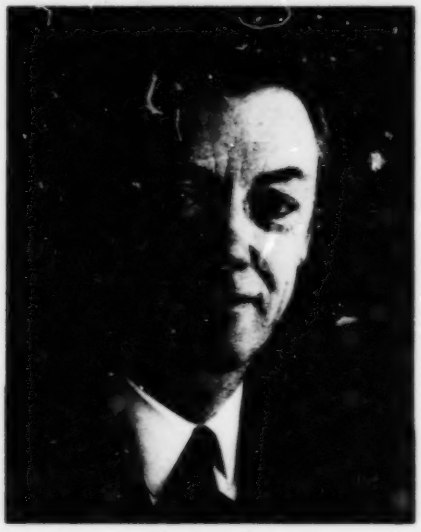


Saskatchewan Research Council Annual Report 1985-86

The Saskatchewan Research Council is an agency of the provincial government, established in 1947 to apply science and technology for Saskatchewan's development.

We are a major research and development organization applying innovative approaches to solving problems in the resource, industry, and manufacturing sectors. A team approach for research and development and technology transfer is used by working with government departments, universities, and the private sector.

CHAIRMAN'S REPORT



Gordon Birney

The business activity of the Saskatchewan Research Council has increased over the last year and our staff complement has grown. In a year of difficult economic influences, SRC has performed well.

Progress has been made through personal accomplishments, and by successes realized through the development of a teamwork atmosphere within SRC's organization.

Some of these achievements include the move of our offices and laboratories to a new location at Innovation Place, the establishment of an Administration and Finance Group as part of the organization structure, the introduction of a revised compensation plan, and the development of an effective Human Resources program. The internal and external communications of SRC were expanded with the development of the Communications group. And, the future development of SRC will be given special attention through a new Business Development Branch. SRC is on the move.

Programs for the year met the needs and demands of society relative to scientific research, development, and implementation. The programs included remote sensing, gold exploration techniques and analysis, computer assisted design and manufacturing, enhanced oil recovery, farm management, aquaculture, and many more.

But a challenge arose. It was the need to formulate and chart a direction for the development of SRC in the future - a most demanding and exciting challenge.

The challenge required intensive study and evaluation of the factors needed to provide a leading-edge role for SRC in meeting future research and development opportunities. The nature of these opportunities, the resource requirements, the skills, the people, and the funding were but a few of the factors to be pondered by the people at SRC through the leadership of President, Jim Hutch.

The direction for the future of SRC has been created to provide a basis for setting goals and objectives, for monitoring future activities and managing its growth. New initiatives have been identified. New opportunities will be available for the people of SRC to exercise their skills and capabilities. As they have in the past, they will continue in the future to set new standards of excellence.

SRC looks positively to the future in continuing to fulfill its mandate to apply science and technology for Saskatchewan's development.

I wish to extend my expression of thanks to my fellow board members for their support and commitment to the future development of SRC, to Jim Hutch in providing a strong leadership role in the development of the corporate plan, and to the people of SRC for their dedication to the well-being of the organization.

Gordon Birney

Gordon Birney, C.A.
Chairman of The Board of Directors

PRESIDENT'S MESSAGE

Saskatchewan Research Council's mandate to "apply science and technology for Saskatchewan's development" places us at the forefront, working on behalf of and with our clients: resource, industrial, and manufacturing-based companies; the provincial and federal governments; our colleagues in universities and technical schools; and other provincial research organizations in Canada.

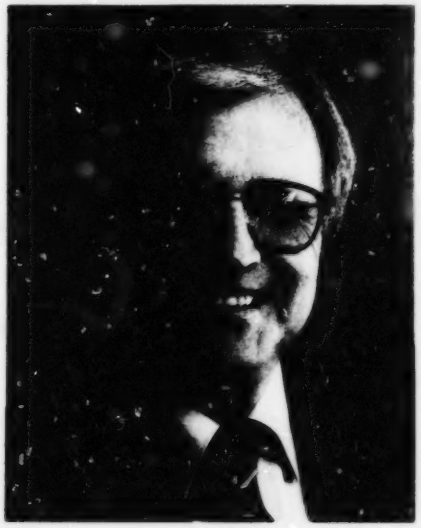
The provincial government's strong and continued support for SRC was demonstrated through a grant of $4.3 million, the provision of laboratory and office space for us at Innovation Place, and a commitment for an addition to Innovation Place to accommodate the remainder of SRC's operations. Our total budget for the period was approximately $15.9 million, which compares to $10.9 million for last year. Our total fee-for-service work of approximately $9 million includes the work of the Petroleum Division which was added to SRC during 1985, and funded by the Canada-Saskatchewan Heavy Oil and Fossil Fuel Agreement. Another $1.4 million is included for an Employment Development Agency program carried out by SRC - the Students-in-Industry/Graduates-in-Industry Program. Overall, a surplus of approximately $300,000 was generated for the year.

In June, 1985, SRC acquired the Heavy Oil Lab formerly owned by Saskoil. The fully equipped facility and its staff of 31 people form the nucleus of SRC's Petroleum Division. This addition to SRC allows us to more completely service the oil industry. In the past our work for the oil industry was primarily in the environmental and pipeline transportation areas.

We continue to increase our services to our clients through cooperative agreements with universities and other research and development organizations. We have signed an agreement to access the services and facilities of the Alberta Research Council's Electronics Test Centre, and will soon have agreements with the Alberta Microelectronics Centre and the Manitoba Research Council's Canadian Food Technology Centre. In return, all of these organizations will make use of services from SRC such as Industrial Engineering, Management Consulting, and marketing capabilities.

A significant feature of SRC's activities is that we are driven by our client's needs. As you read through the remainder of the report you will note the number of activities designed to respond to the needs of our clients:

- mineral and metal exploration, development, production and safety
- heavy oil development
- farm input cost savings and increased safety
- manufacturing needs for product and process development and adoption of new technologies to improve profitability through improved productivity



Jim Hutch

- environmental work regarding water supply, air quality, soil reclamation, and conservation
- services such as analytical work, inventor's services, product development and testing.

SRC's staff of scientists, engineers, technologists and support staff have performed extremely well as our results show. Our Board of Directors provided us with their guidance and advice throughout the year, and I wish to thank all of these people for their efforts in making this a very successful year.

As we look to the future we see that the importance of research and development and technology transfer are significant factors to deal with in a very competitive market. We must accomplish more with less, and be quicker to remain competitive in the global market we face today.

The world market situation for agricultural products, potash and oil are particularly hard hit. It is at times like this that we must realize and maintain our commitment to the future. SRC's activities are part of the solution and our priorities are those of the province. We are committed to be a productive member of the team finding solutions to the complex problems facing us today.

Jim Hutch
President

Research and Development Branch

Resources Division

Saskatchewan's natural resources must be used efficiently to gain optimum benefits for the province. Our Resources Division provides applied research, development, and demonstration projects for Saskatchewan's industrial, agricultural, and resource-based economy. As is true for every research activity at SRC, our goal is to transfer the technology we develop and test.

Mineral Resources

Aiding exploration for uranium deposits in northern Saskatchewan

Our researchers participated this year in an international symposium in France where SRC's findings on the genesis of uranium deposits were presented. Closer to home, a project was initiated to determine the geologic age of diabase dikes that intrude the sandstone of the Athabasca Basin. The project's purpose is to establish the possible relationship between episodes of diabase magmatic activity and the various stages of unconformity-type uranium mineralization that have been recognized to date. The project is partially funded by the federal department of Energy, Mines and Resources and is being conducted in cooperation with the Department of Geology at the University of British Columbia.

Samples of glacial till from northern Saskatchewan are studied as part of drift prospecting work in the Sedimentary Resources program. Brent Campbell operates a shaker table to concentrate metallic mineral grains, including gold, in a till sample from the Waddy Lake area.

Also related to the Athabasca Basin is a project underway with the University of Saskatchewan in which our scientists are studying stable isotopes of carbon, hydrogen and oxygen in minerals to characterize the uranium ore-forming fluids. The expected outcome is a clarification of the connection of ore formation to the evolution of the Athabasca Basin.

Another project is a study of fluid inclusions in minerals from gold occurrences in the Beaverlodge district of northern Saskatchewan. The expected outcome is a better understanding of the origin of the mineralization and an assessment of the mineral potential. This project is being conducted in cooperation with the Saskatchewan Department of Energy and Mines, and the University of Saskatchewan.

Preliminary results of the Gold Lithogeochemistry and Metallogenesis project are printed under the report title, *Lithogeochemistry Related to Gold in Saskatchewan*. A cooperative project is underway with Saskatchewan Energy and mines (Creighton) to compile and interpret geochemical data related to gold mineralization in the Flin Flon area.

Geochemical Services

Providing necessary support to industry

Geochemical Services provides Saskatchewan's mining exploration industry with a wide variety of geochemical analyses of rocks, ores, minerals, sediments and vegetation for their mineral exploration programs.

Approximately 23,000 samples were analyzed during the year for an average of 10 elements per sample. About 80 percent of the analyses were related to uranium exploration and development, and the remaining analyses were related to exploration for gold and other metals.

The geochemistry laboratory is a modern, automated, analytical facility that has established computer data links with some of its clients. New analytical techniques are developed in cooperation with clients requiring specialized analyses.

Sedimentary Resources

Groundwater resource evaluation

About half of Saskatchewan's population depends on groundwater as a water supply. It's an economical alternative to surface water and also provides dependable and inexpensive insurance against emergencies which could make surface water supplies unavailable.

The groundwater resources of the Regina area were evaluated this year for the City of Regina, Saskatchewan Water Corporation, and Saskatchewan Department of Environment.

The data are used in the management and protection of Regina's groundwater supplies. To investigate pesticides in groundwater, a surficial aquifer (water bearing deposit) near Nokomis was instrumented to monitor water level and water quality changes. This work is being done in cooperation with the National Hydrology Research Institute, (NHRI).

Saskatchewan's natural resources must be used efficiently to gain optimum benefits for the province.

Also with the NHRI, piezometer nests near the town of Riverhurst were tested and sampled. The piezometers, installed in the 1960's by the Geological Survey of Canada, are a tool used to study the influence of filling Lake Diefenbaker on groundwater levels in underlying aquifers.

Protection of groundwater supplies from contamination requires detailed knowledge of the location of the aquifers and the movement of groundwater. Geology and groundwater information in the form of maps, cross sections and other data is being compiled in Saskatoon, North Battleford, Melville, and other areas throughout the province as part of a new information series. These compilations establish the geological framework, define aquifers, and determine their usefulness as water supplies. The work is being done in conjunction with the Saskatchewan Institute of Pedology, particularly relating groundwater conditions to the cause of soil salinity. The Saskatoon area will be the first compiled using a new computer-assisted mapping system being developed at SRC.

Sand and gravel inventory for the construction industry

The demand for sand and gravel resource information in the construction industry is being answered by compiling a series of 1:250,000 reconnaissance maps along with 1:50,000 scale maps in areas of high demand. Aggregate resource mapping continued

in the Saskatoon and North Battleford areas. To date 11 - 1:50,000 scale maps of sand and gravel resources have been completed near Saskatchewan cities.

Geological research on drift prospecting for gold

Studies related to drift prospecting for gold in the La Ronge Belt and other areas of northern Saskatchewan were undertaken in cooperation with several mining companies. Drift prospecting is a method of tracing minerals, dispersed in glacial deposits, or drift, back to their origins. A review entitled *Quaternary Geology As A Guide To Mineral Exploration In The Southeastern Shield* was done as a joint project with Saskatchewan Energy and Mines as part of the Canada/Saskatchewan mineral development agreement.

Defining surface materials for resource development

Most of Saskatchewan is covered by a blanket of Quaternary deposits which varies in extent and thickness throughout the province. Surficial geology maps delineating surface materials and landforms are being compiled for southern Saskatchewan to provide background information for groundwater supplies, aggregate resources, and geotechnical investigations. This information for the south will be combined with the information previously collected for the northern Shield area to produce the first 1:1 million Quaternary geology map of Saskatchewan.

As is true for every research activity at SRC, our goal is to transfer the technology we develop and test.

The sedimentology of the classic point bar deposits of the Saskatchewan River near Nipawin was documented to understand these unique and valuable gravel sources and provide information to support archaeological investigations done prior to flooding by the hydroelectric reservoir. Augering was completed in the delta deposits at Cumberland House to obtain samples for age dating. This data will add to the understanding of the Nipawin Delta and complete a study of Lake Agassiz and its relation to the Saskatchewan River.

Biomass Resources

Research spans several areas of the agricultural sector

The utilization of natural herbicides occurring in crop residues and green manure crops is being investigated with the University of Saskatchewan. The objective of these studies is to learn how to design and manage crop systems to utilize these substances to reduce weed control costs. A mixture of sweet clover mulch and young growing winter wheat was effective in controlling a test broadleaf weed.

Kochia continues to be investigated as a high yielding forage crop for saline areas. A number of cooperative trials with Agriculture Canada at Swift Current were conducted this year. Observations by farmers have indicated that kochia appears to be resistant to grasshopper damage. Field trials on this possibility are planned for 1986.

Wheat chaff was investigated as a possible industrial raw material. This use would be an extension of its present use as a low cost cattle feed after ammonia treatment. Two industrial pretreatments, ammonia freeze-explosion, and steam explosion, were investigated in cooperation with Forintek and Colorado State University. The chaff responded well to both pretreatments.

Solid-state aerobic fermentation of straw or chaff with white-rot fungi was tested as a means to produce cell wall degrading enzymes such as cellulases, hemicellulases and pectinases. Considerable progress was made in developing enzyme systems to improve canola oilseed processing and the results of the study were reported at an international meeting.

A new energy cost management program called Farm Enerdemo was started with 38 farmers cooperating. Funding is provided by Energy, Mines and Resources Canada. Although fuel prices have dropped, so have grain prices; therefore, energy cost management continues to be important. On the basis of fuel and fertilizer records kept in 1985, farmers are planning and making changes to their farming practices. Computer programs to evaluate new cropping systems have been designed by private consultants who are part of the project.

Resources Processing

Stress measurement in potash mines

Accurate knowledge of the stress behaviour of potash permits safe extraction in the mines, and this improves the economics of the potash industry. To meet the needs of this industry, the development and

fabrication of stress cells and other rock mechanics instrumentation continued at a substantial level. Upgrading and commissioning of four triaxial pressure cells for measuring the stress behaviour of potash and other soft minerals were completed; in-house research and contract work using this facility is anticipated next year.

Ceramic research leads to feasibility study

The continuing investigation of methods to upgrade Saskatchewan kaolin reached fruition this year. The work was instrumental in the decision reached by Ekaton Energy Ltd. to do a feasibility study for a kaolin production plant at Wood Mountain, Saskatchewan.

Laboratories and pilot plants maintained for mineral processing

A study of gold recovery from cyanide-leached pulps, using carbon-in-pulp technology, and an investigation of the particle size distribution of ground uranium ore were done for Melis Consulting Engineers Ltd. in our laboratory. In addition, a graphite exfoliation study was done for the Saskatchewan Mining Development Corporation and several small studies done for Saskatchewan Minerals and Saskatoon Chemicals.

Slurry Pipeline Development Centre

The work at our *Petroleum Division* is complemented by the heavy oil transportation research carried out in our *Slurry Pipeline Development Centre*. This year the internationally recognized centre continued pipeline tests on oil-in-water emulsions, heavy oil-diluent mixtures and flow conditions arising in horizontal short distance pipelining of a coarse slurry. The Centre also conducted a major study of slurry transport of coarse tailings for Suncor, Inc.

Buildings & Energy Technology

Research completes major contract

A four-year contract from Energy, Mines & Resources Canada (EMR) was finished this year. Under this contract, our staff managed a large research, development, and technology transfer program for EMR, involving energy conservation consultants and specialists from Vancouver to St. John's. Work now is focussed on exploring new avenues of contractual research, which complements the recently established Product Development and Testing Laboratory.

The management of Saskatchewan Agriculture's Compressed Natural Gas Farm Demonstration Project is underway. This is a major provincial initiative that has attracted supplementary funding from EMR.

At a local level, staff have a number of contracts relating to residential energy conservation. The largest of these require us to develop a new system of standards and health controls relating to the indoor use of caulks, sealants and weatherstrip.

SRC's Enerdemo program demonstrates the tools and techniques needed to reduce fuel consumption in all farming operations. Over 50 farmers are participating in the demonstration project. Here, Mark Gimby, of SRC, (right) discusses fuel use records with an Enerdemo farmer.

Petroleum Division

Help for Saskatchewan's oil industry

The Petroleum Division, based in Regina, embraces the challenge of recovering Saskatchewan's vast heavy oil reserves. This technical centre of expertise explores a full range of heavy oil projects from enhanced oil recovery techniques, to production, treatment and upgrading of heavy oil for refining.

Enhanced recovery

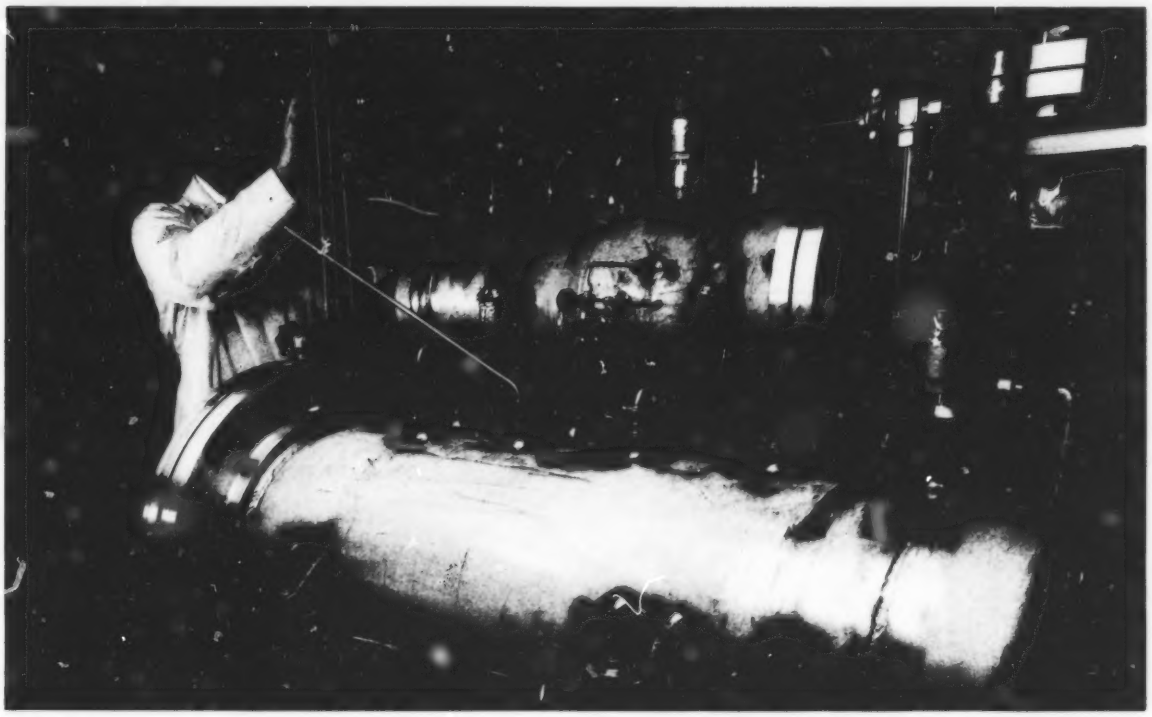
In the area of petroleum recovery, primary and secondary (waterflooding) recovery processes only recover about seven percent of the initial oil-in-place in Saskatchewan's heavy oil reservoirs and about 25 percent from our light and medium oil reservoirs. The application of enhanced oil recovery (EOR) technologies could raise these recovery factors to 30 percent or more for heavy oil and to 35 to 45 percent for light oil.

Steam injection is an EOR method used to reduce the viscosity of heavy oil by adding heat to the reservoir. This year a physical model was designed to help investigate the steam injection process.

In-situ combustion, or fireflood, is another EOR technology that heats the reservoir by burning the heavy fraction of the oil in the reservoir with injected air. To study the process, SRC installed, tested, and developed operating procedures for an automated combustion tube this year.

Immiscible carbon dioxide flooding is EOR technology for heavy oil that reduces viscosity of heavy oil through chemical means rather than through the addition of heat. A paper entitled, "A Laboratory Study of Heavy Oil Recovery with Carbon Dioxide" was presented at an industry conference this year and published in the March-April 1986 issue of the *Journal of Canadian Petroleum Technology*.

Fast responses to oilfield production problems are possible with this Mobile Emulsion Treating Unit, designed and constructed at the SRC Petroleum Division. Jerry Scoular operates the trailer-mounted system which can be moved from laboratory to wellhead to treat oil emulsions.



Miscible carbon dioxide flooding appears to be a promising EOR technology for Saskatchewan's light and medium oil reserves. In this vein, slim tube miscibility experiments and phase behaviour studies conducted at SRC show that both CO_2 and ethane are miscible with the southeast Saskatchewan light crude tested at pressures below the reservoir fracture pressure.

The characterization of reservoir fluids helps our researchers understand the thermal, physical and chemical behaviour of oils from Saskatchewan reservoirs. Thermal studies at SRC resulted in a paper entitled, *"Screening of Heavy Oil Reservoirs for Enhanced Oil Recovery by Thermal Methods."* In a cooperative project with the University of Regina, SRC is studying thermally-induced chemical reactions.

And onto other production and upgrading problems

Once a recovery technology has been chosen, there are still other technical problems that arise during the production, treating, transportation, and upgrading of heavy oil. Sand control is one area of research at SRC that is aimed at a common oilfield production problem - the influx of formation sand into the wellbore of heavy oil producing wells. Work this year led to a hypothesis that is being confirmed through further work. If the work confirms the theory, it should help companies identify problem wells before it's too late to correct the situation.

Emulsions of water-in-oil are formed during enhanced recovery operations. Some of these emulsions are difficult to break into pipeline-quality oil and clean disposal water. Work is underway at SRC to improve existing breaking/treating technology and develop new technology.

Chemical and physical characterization of emulsions is used as a tool to correlate emulsion properties with stability and, ultimately, to gain an understanding of the mechanisms of emulsion formation. Mechanical demulsification work is focussing on improved mixing methods. A trailer-mounted treatment system that will allow testing of new technologies at the wellhead is being built. Also during the year a cheap and efficient method was developed to reduce the viscosity of fluids in the wellbore of heavy oil wells to make the oil pumpable.

Before heavy oil can be refined it must be upgraded. One concern regarding upgrading Saskatchewan's heavy oil is that the upgrader must cope with a variety of feedstocks. In particular, crude oils obtained through some enhanced recovery techniques exhibit markedly different upgrading characteristics than oil produced by primary or secondary methods. A study of the processing characteristics for Saskatchewan's heavy crude oils produced by enhanced recovery is underway. As well, secondary upgrading (hydrotreating) is needed before heavy oil fractions can be refined. The second upgrading project is testing the effectiveness of various catalysts when hydrotreating partially upgraded gas oil distillate.

PETROLEUM DIVISION MANAGEMENT ADVISORY BOARD

Dale Christensen
Vice President
Resource Development
Saskoil, 1000 Saskoil Tower
Regina, Saskatchewan

Bud Dahlstrom
Manager
Consumer Co-op Refinery
Regina, Saskatchewan

Bill Husband
Vice President
Research & Development
Saskatchewan Research Council
Saskatoon, Saskatchewan

Jim Hutch
President
Saskatchewan Research Council
Saskatoon, Saskatchewan

Bud McLean
Vice President
Production
Murphy Oil Limited
Calgary, Alberta

Doug Miller
Executive Vice President
Westmin Resource
Calgary, Alberta

George Miller
President & Director of Research
Nova Husky Research Corp. Ltd.
Calgary, Alberta

John Reid
Assistant Deputy Minister
Saskatchewan Energy & Mines
Regina, Saskatchewan

Art Wood
Vice President, Heavy Oil
Norcen Energy Resources Ltd.
Calgary, Alberta

Bob Skinner
Assistant Deputy Minister
Petroleum
Energy, Mines & Resources
Ottawa, Ontario

PETROLEUM DIVISION TECHNICAL ADVISORY COMMITTEE

Les Court
Project Manager
NewGrade Energy Inc.
Regina, Saskatchewan

Roy Jeffries
Manager
Engineering & Construction
Husky Oil Limited

Glen Yeryk
Manager
EOR Projects
Saskoil
Regina, Saskatchewan

Jim El Defrawy
Director
New Petroleum Supplies
Energy, Mines & Resources
Ottawa, Ontario

Jim Hutchinson
Director
Petroleum Division
Saskatchewan Research Council
Regina, Saskatchewan

Robert King
Research Associate
Texaco Canada Ltd.
Calgary, Alberta

Tom Strickland, Jr.
Manager, Enhanced Oil Recovery
Heavy Oil Division
Husky Oil Limited
Calgary, Alberta

Bill Thornton
Manager, Enhanced Oil Recovery
Murphy Oil Company Ltd.
Calgary, Alberta

Tom Beale
Manager, Engineering
Norcen Energy Resources Ltd.
Calgary, Alberta

Dan McFadyen
Director, Energy Technology Branch
Saskatchewan Energy and Mines
Regina, Saskatchewan

Bill Husband
Vice President
Research & Development
Saskatchewan Research Council
Saskatoon, Saskatchewan

Robert Faulkner
Manager, EOR
Shell Canada Resources Ltd.
Calgary, Alberta

Environment Division

The quality of Saskatchewan's water, land, and air resources is a public concern. To meet this concern, SRC has an Environment Division staffed by environmental scientists working on public and private sector contracts. These scientists provide research to clients on the maintenance, management and improvement of the province's environmental resources. Emphasis is placed on assessing the environmental impact of industrial activity, transportation, and other major developments for today and tomorrow.

Atmospheric Processes staff study and classify the behavior of the atmosphere, including its interaction with industrial emissions. Contract-based air quality monitoring takes program staff to mine sites and power plants throughout the province. Here, James Ross (left) and Rod Bouvier (right) sample stack gas emissions from a mine mill roof-top.

Atmospheric Processes

Studying the provincial climate

Climatic impact assessment studies examine the effect that man's industrial activities have on our climate. The inverse relationship is also analyzed: the effects of climate on man's activities such as mining and agriculture.

For any professional climate study it is necessary to have access to a comprehensive data base. Our climate reference station is semi-automated and the program includes weather observation, archives and summaries of the material. It also provides a data base for the Saskatoon area which is used for numerous requests for climate information from the University of Saskatchewan and various agencies.

Air quality programs

An air quality modeling service to industry continued this year. The service tells our clients whether their new or existing emission sources meet the provincial government standards. Industrial clients purchase emissions testing and in-plant efficiency analyses from our personnel on a contract basis. The work not only fills a direct need for the provincial industrial community but also carries a mandate for continued updating of present activities in the areas of emissions monitoring. The work has ranged from

testing alternate-fueled engines to evaluating different scrubbing systems for the potash industry. Saskatchewan's potash mines and other specialty industries use these services.

Long range transport of air pollution

One of the most newsworthy issues of today is the public concern about acid rain and its impact on our environment. SRC conducts an acid rain program with various clients in which the rain and snow of the province are studied for ion balances. The studies reveal the extent of acid rain damage to Saskatchewan's environment. The studies include both wet and dry deposited acidic matter and have taken the programs into the leading edge of technology due to one of our discoveries: a series of natural acidification processes have been found in northern Saskatchewan that have been unknown to date. Results from our program could have implication on a world-wide basis.

Attention given to farming community

A number of projects were undertaken this year to assist the farming community with problems related to meteorology and agriculture. A watching brief on the current drought cycle in Saskatchewan is ongoing, as is a study that considers the impact of an increasing climate change scenario on various aspects of agriculture and its practices in the province. Related to agriculture, of course, is the issue of farm chemicals and how they affect farmers working with them in the field. Clients, such as agricultural chemical companies, require field testing of their chemicals prior to licensing to ensure they are safe for farmers to handle. SRC conducts these contract studies focussing on a select group of other substances found in the air of the workplace.

SRC has, for many years, been a leader in pesticide sprayer droplet technology. Major programs have been conducted under contract to determine the impact that droplet generation devices (nozzles) have on the amount of pesticide drift and deposit, from typical agricultural operations. Sprayer design and nozzle technology are evaluated by this program; it will focus more directly on ways to reduce farm input costs by using more efficient spray procedures.

SRC conducts contract work with Agriculture Canada on a micrometeorological program to measure vapour movement to the atmosphere. Agricultural pesticides are applied to fields in the province and our program measures the amount of pesticide returning to the atmosphere as a contaminant from various field exposures.

Terrestrial Ecology

Assisting with the protection of provincial renewable resources

SRC continues to study the revegetation potential of the coal spoils of southern Saskatchewan. The work is carried out in our Terrestrial Ecology Program where help is available to industry and government with land development projects to ensure compatibility with the protection and enhancement of Saskatchewan's renewable resources.

A two-year study to evaluate the potential effects of oil well drilling wastes on crops and soils is underway. This study is funded by Saskatchewan Energy and Mines, the Canada-Saskatchewan Heavy Oil and Fossil Fuel Agreement, and SRC.

Monitoring of soils and crops for Saskatchewan Power Corporation continued in the Coronach area to determine the environmental effects of the airborne emissions from the Poplar River Thermal Power Station. And, work continued on the second phase of a three-year study of the potential effects of acidic precipitation (acid rain) on Saskatchewan crops and forest tree species. Saskatchewan Environment, Saskatchewan Power Corporation, and SRC jointly funded this year's program.

A study, funded for the second year by Saskatchewan Agriculture and SRC, looked at a naturally-oxidized fossil material to evaluate possible soil improvements. The material is found in large amounts in the Estevan area.

SRC assisted Saskmont Engineering prepare the vegetation and agricultural land use components of the Environmental Impact Assessment for the proposed Shand Power Plant and Rafferty and Alamenda Reservoirs in the province.

A range management booklet was written to help range managers and ranchers minimize the adverse effects of drought on range plants and animals. The booklet is based on available literature as well as on data collected by SRC in the various grassland regions of the province in the past seven years. *Drought And Saskatchewan Rangeland: A Management Guide*, is available through our Information Centre.

Surface Hydrology

Remote Sensing: observing the earth from space

SRC's Remote Sensing Centre continues its lead role in transferring and demonstrating technologies that apply remotely-sensed satellite data to the management of provincial resources.

At the Remote Sensing Centre, the Saskatchewan Technology Enhancement Program (STEP) completed its second year of operation under joint management by SRC, the Canada Centre for Remote Sensing, and Department of Energy, Mines and Resources. Program staff managed 10 demonstration projects for staff professionals from several government departments and agencies, including: Saskatchewan Parks and Renewable Resources, Saskatchewan Department of Agriculture, Saskatchewan Crop Insurance Corporation, and Saskatchewan Water Corporation.

As part of the demonstration projects, remote sensing technologies and digital analysis equipment at SRC were used to monitor and map provincial resources as diverse as forestry, water, wildlife habitats, mineral deposits, agriculture and wetlands.

In addition to demonstration projects, STEP has stimulated remote sensing activity and broadened provincial user expertise by conducting 12 remote sensing operators' courses; 11 seminars on applications such as wildlife habitat, water resources, geology, agriculture, rangeland, geographic information systems, forestry and Radarsat; three workshops; and 30 lab demonstrations. The program publishes the quarterly *Saskatchewan Remote Sensing Newsletter.*

Water studies at SRC

Our scientists continue to develop process knowledge and management alternatives related to surface water. Technicians at SRC have made a break-through in the ability to monitor water quality parameters simultaneously instead of sequentially. This improves the accuracy of sampling and detecting industrial dumping. The Grand River Conservation Authority in Ontario was our major client. The Streamflow Synthesis and Reservoir Regulation (SSARR) from the U.S. Corps of Engineers was used to simulate Probable Maximum Floods for the Rafferty Dam. Digital terrain models were used to improve on the accuracy of snow measurements.

A long-term study, relating to Big Quill Lake, bore fruit this year with the construction of a potassium sulphate plant near Wynyard. The $1.5 million study was conducted under the joint federal/provincial Agriculture and Rural Development Agreement (ARDA). The results were used in the feasibility study. Over $50 million will be spent on the plant which is producing 300 tonnes/year of potassium sulphate and may be increased to 300,000 tonnes/year. The plant uses the highly salty waters of Big Quill Lake.

The surface hydrology program also provides essential hydrologic and remote sensing input into environmental impact studies for mining and thermal-electric developments.

Aquatic Biology

Water quality objectives developed

Our aquatic biology program completed the *Canadian Guidelines for Surface Water Quality to Protect Freshwater Aquatic Life* for the Canadian Council of Resource and Environment Ministers. The guidelines will provide all provinces with an up-to-date scientific basis for the development of water quality objectives.

SRC designed a water quality study of the Saskatchewan River, for Saskatchewan Environment, who carried out the study using their technical staff. We have been monitoring the water quality of the Saskatchewan River in the vicinity of the Nipawin Hydroelectric Project for Saskatchewan Power Corporation since 1982. The formation of the reservoir and the start-up of power generation has now been underway for one year, resulting in an increase in our sampling activity.

The compilation of a data base on uranium series radionuclides in aquatic biota in northern Saskatchewan continues. This data base was used to evaluate the suitability of Atomic Energy of Canada's LIMCAL model, which deals with radionuclide transfer via food chains to man. Preliminary work is complete. Background levels of uranium series radionuclides in vegetation in northern Saskatchewan and adjacent Northwest Territories were measured and assessed in a joint study with the University of Saskatchewan, funded by Environment Canada, the Saskatchewan Health Research Board and Indian and Northern Affairs Canada.

Aquaculture projects include growout and broodstock development of rainbow trout, caged culture of rainbow trout, and the development of culture methods for arctic char. In addition to research and development, SRC offers courses in fish farming as part of our technology transfer work. Approximately $400,000 in capital expenditures in Saskatchewan aquaculture are a result of technology transfer from SRC to the private sector.

An industry-led feasibility study and a literature review of the potential for developing a crayfish industry in Saskatchewan is complete. Test marketing of Saskatchewan's abundant crayfish in Scandinavian countries revealed they were not acceptable because of their small size.

SRC continues to investigate current and potential economic benefits from aquatic plants. Work was completed on demonstrations using cattails as a home heating fuel and feeding trials using cattails as animal feed for cattle and sheep. SRC helped the Meadow Lake Cattail Co. improve a sewage treatment pond by seeding it with cattails.

In another example of technology transfer, SRC helped to supervise Freshwater Institute staff as they developed sampling and hatching techniques for brine shrimp.

Other clients this year included the Potash Corporation of Saskatchewan, and Saskatchewan Water Corporation.

Archaeology

Heritage conservation through research

The archaeological heritage of the province is a fragile resource that is easily disrupted when a land-altering development, such as the construction of a highway, is carried out. To mitigate the adverse effects of such projects SRC's archaeology program engages in heritage resource consulting to both government and the private sector. Heritage conservation through research is the term that best describes the work of SRC's archaeology team which, for 10 years, has been actively involved in the study and preservation of Saskatchewan's heritage.

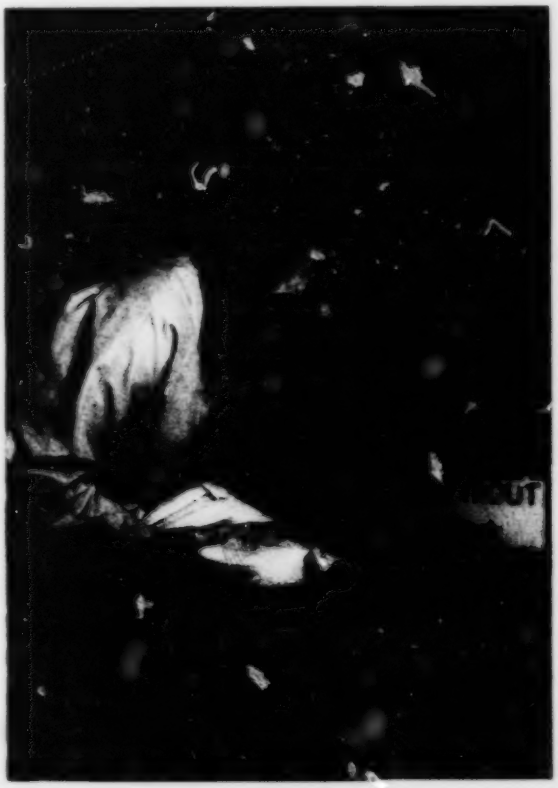
In this vein, the field research for the Nipawin Reservoir Heritage Study was completed after five seasons of work related to the construction of the Francois-Finlay Hydroelectric Station near Nipawin. The team excavated 13 sites in the reservoir area.

The Estevan-Weyburn region was the focus of several studies. Monitoring operations were carried out on trenches excavated for a water pipeline and several petroleum pipelines. Twenty-one prehistoric hearths were exposed in the walls of one trench. Radiocarbon dates obtained on samples from the hearths indicated that the majority of them were about 1100 years old. A survey connected with the proposed realignment of Highway 47 through the Souris River valley south of Estevan also was completed. Several sites were recorded, one of which, a late prehistoric campsite, was excavated. It produced many projectile points and potsherds.

A section of the Red Deer River near the Manitoba border received attention from the archaeology team when a large sand and gravel extraction operation was proposed for the area. Two of the sites recorded were the object of limited excavations, which confirmed the importance of the region as a source of the type of chert (a flint-like material) once used widely by prehistoric peoples to manufacture tools.

A survey was also conducted on the Saskatchewan River in the James Smith Reserve where a number of developments are proposed. Many prehistoric sites were recorded and an 18th century fur-trade post was examined. The large crew involved not only SRC archaeologists but also members of the James Smith band and a volunteer work group formed mainly of Europeans under the auspices of the Canadian Bureau of International Education.

A provincially-funded research project involved the re-assessment of the late prehistoric Selkirk culture which dates from A.D. 1200 to 1700. This study is a key element in delineating and dating the prehistory of the Cree peoples.



Aquaculture research at SRC supports a growing community of provincial fish farmers with new management techniques, equipment development and seminars. Rainbow trout brood stock are now established to supply SRC's research hatchery. Ken Bindle milks eggs from a mature trout for use in the project.

Technology Transfer at SRC

The delivery of practical tools and "know-how"

We develop, test and refine technologies and concepts, and transfer these to business, industry, and government in an effective form—as tools.

Product and Process Development

Turning CAD/CAM into an everyday tool

Tools such as Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) have been introduced to the province's manufacturing sector by the engineers in our Product and Process Development Division. Our CAD/CAM Robotics Centre operates as a "centre without walls" and this year placed six work stations on the shop floors of participating companies. At SRC, we provide these companies with the staff training and technical support they need to turn CAD/CAM into an everyday tool. The work stations were installed with financial support from the Department of Regional and Industrial Expansion (DRIE) and Canada Employment and Immigration Centre (CEIC).

Another 25 companies were involved with related projects.

CAD/CAM Robotics Centre Advisory Board 85/86

Glenn Hantke
Product Development Supervisor
Morris Rod-Weeder Co. Ltd.
Yorkton, Saskatchewan

Bruce Cooke
Dean of Engineering
University of Regina
Regina, Saskatchewan

Rainer Andersen
Director, Program Operations
Saskatchewan Region
Regional Industrial Expansion
Saskatoon, Saskatchewan

Dennis Johnson
President
Pakwa Engineering Ltd.
Saskatoon, Saskatchewan

Ken Lesarge
Manager of Engineering Services
Westank-Willock Ltd.
Regina, Saskatchewan

SRC transfers technologies and expertise throughout the world to aid provincial manufacturers. In 1986, Jim Hutch, SRC President, (seated, right) led SRC engineers to Heilongjiang Agricultural Mechanization Institute, Harbin, China. A delegation from the institute, which included Jiang Guohua, (seated, left) concludes their return visit to SRC by signing an agreement to continue technology transfers in agricultural engineering.

Gordon Pierce
Director, Product and Process Development Division
Technology Transfer Branch
Saskatchewan Research Council
Saskatoon, Saskatchewan

Alan Scharf
President
Scharf and Associates
Saskatoon, Saskatchewan

Management Consulting

Meeting business needs

The consulting program provides industrial and management consulting services to government departments, private industry, crown corporations, municipal governments, and associations. This year's projects covered a wide spectrum of business needs. The work continued on the application of Distribution Requirements Planning (DRP) system for a large corporation and several marketing and feasibility studies were completed.

Consulting staff use overall productivity improvement strategies, and have trademarked a specific approach under the name Cost Leadership™. Cost Leadership is a management strategy designed to help business produce products or services at a lower cost than competitors. In any market, the cost leader is characterized by being the most effective, profitable, competitor; this means maintaining the product's price and quality, but with production costs that are lower than the competition's.

Saskatchewan's Product Development Management Program (PDMP) is another management resource handled by program staff. PDMP, funded by Saskatchewan Tourism and Small Business, has assisted over 40 manufacturers to date. This help has ranged from engineering design to marketing strategy development. This year the program funded six projects.

Regular sources of management information are supplied to clients through seminars and publications: *Technology Transfer* (quarterly) and *Management Insights* (quarterly). They have a combined circulation of about 5,000. Seminars sponsored and presented by the program cover topics such as Materials Requirement Planning (MRP), Industrial Marketing, Cost Leadership, Systems Design, Time Management and CAD/CAM.

A research project funded by the International Development Research Centre (IDRC) entered its second phase this year. The project is designed to study the process of technology adoption by small and medium-sized enterprises in Malaysia. It's a joint project undertaken by the University of Saskatchewan and SRC together with two educational institutions in Malaysia.

Field Services

Delivering engineering assistance

Nine of our engineers work in the Field Services Division where the National Research Council's Industrial Research Assistance Program (IRAP) is operated for Saskatchewan.

The highly successful program is designed to add thrust to the economic development of the province in a very direct manner. Our engineers visit small and medium-sized manufacturing firms throughout Saskatchewan, providing them with technological information, advice, and guidance on industrial engineering methods and techniques. IRAP is also designed to stimulate industrial research and development in the province. The IRAP/Saskatchewan engineers help companies access funds available from NRC to develop or improve products and processes.

Our IRAP field advisors have five programs they use to apply to the various manufacturing needs and problems they encounter: IRAP-C, Field Advisory Service; IRAP-H, Contributions to Firms Employing Undergraduates; IRAP-L, Contributions to Laboratory Investigations; Project-M, Contributions to Small Projects; and IRAP-P, Contributions to Large Projects.

Again this year we ran the Students In Industry program for the provincial government. The overall program was expanded to include graduate students and became known as Students In Industry/Graduates In Industry.

The Inventor Services Program is administered by SRC on behalf of Saskatchewan Science and Technology. The program encourages inventors to perform an evaluation of ideas and inventions at an early stage, before money is spent for patents, licenses or further development.

Innovation

Bridging the gulf between idea and start-up

The second year of our Innovation Division's work brought in some impressive results. The Division provides a bridge between product conception, research and development, and start-up. Among the products involved were a unique conveyor belt, a wheelchair lift, and an innovative pump jack. The Division works closely with the Department of Regional and Industrial Expansion and Saskatchewan Tourism and Small Business to help launch economically viable products in the province.

Administration and Finance Branch

The Administration and Finance Branch has concentrated this year on the development of policies, analysis and refinement of administrative systems, and cooperative team building, both within the Branch and the whole of Saskatchewan Research Council.

Human Resources

Policy development, compensation studies, training, employee benefits and corporate planning were the focus of this year's Human Resources activities.

A new Employee Dental Plan with top-up option was introduced in May of 1986. Human Resources planning focussed on improved employee training. The study identified a corporate commitment to programs such as Kepner-Tregoe, Achieve-Front Line Supervision, Stress Management, and Project Management.

Departmental Services

The prime service of this group is the provision of word processing for SRC.

This year 259 scientific/technical publications were produced by SRC. SRC has produced some 2,866 scientific/technical papers and reports since 1957, most of which are available to clients through our Information Centre.

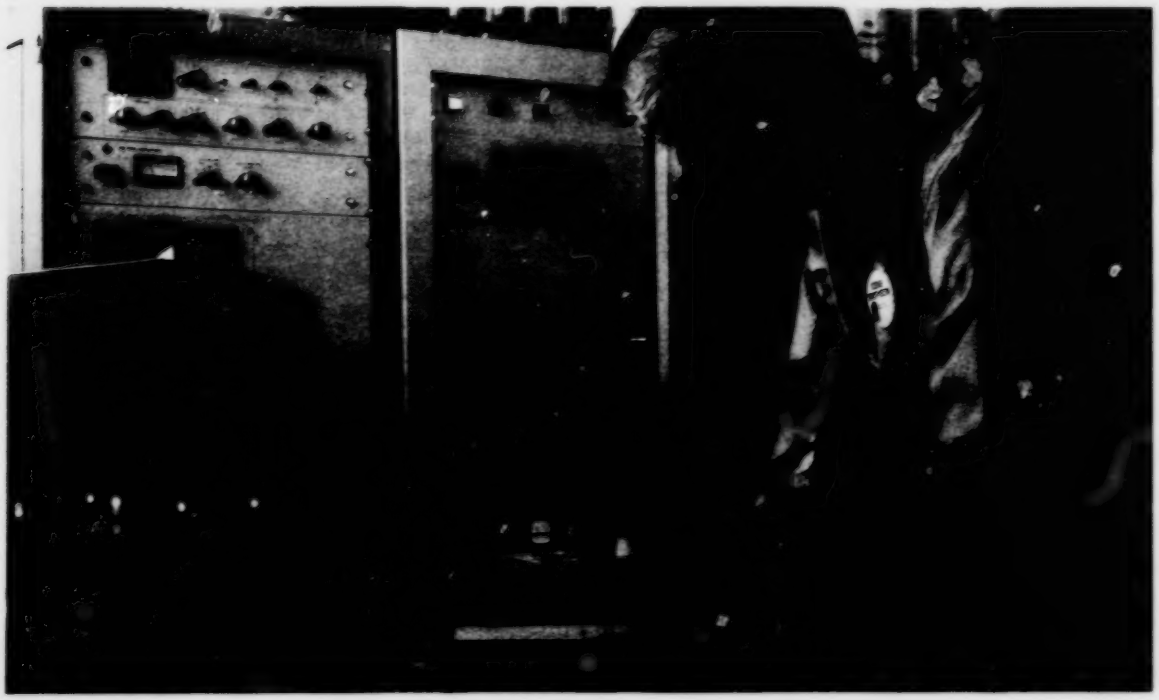
Masters of all publications from 1975 on are readily available for our clients.

Information Centre

A complete library facility provides technical information support for all research programs at SRC.

A reference collection, current documents from Canadian and international government agencies and research organizations, and a book collection relating to science and technology complement online information retrieval facilities, with access to approximately 1,000 databases in the science and technology fields. Current public SRC technical reports are supplied, through a mailing list, and on an individual request basis to libraries and research organizations worldwide.

Analytical Services laboratory staff provide chemical analyses on a variety of environmental and mineral resources samples. Trace element measurements, in the parts per trillion range, are produced by this plasma-mass spectrometer, operated by Gene Smithson.



Graphics Services

Specialized graphics services including consulting, cartography/drafting, photography/photomechanics, audio-visual, reports/publications and display presentations are provided to all SRC programs and clients.

Graphics Services maintain a complete, multi-scale map/air photo library of the province, which provides SRC and its clients with a valuable resource. The library is complemented by a unique 1:50,000 air photo mosaic collection covering Saskatchewan and its immediate bordering areas.

An in-house Copy Centre, providing electrostatic copying services, binding, and other report production services is an integral component of Graphics Services.

Shops and Facilities Services

The maintenance of SRC facilities and equipment is managed by seven tradespeople, who also provide services in the design, fabrication, and/or assembly of specialized equipment required by SRC programs.

Safety

This SRC service helps ensure personnel enjoy the benefits of a healthy and safe working environment. A few highlights from the year include tours of SRC facilities with some of our regulatory agencies; providing advice in the correction of any building deficiencies; sponsoring courses for staff in areas such as First Aid Training, and assuring that SRC complies with new Occupational Health and Safety Regulations.

Analytical Services

A Laboratory at the forefront of analytical technology

The Analytical Services Laboratory of SRC provides chemical, radio-ohemical and materials analysis on a fee-for-service basis to private, commercial and government clients within Saskatchewan. These services fall within three main areas: water and general chemistry, radiochemistry and chromatography.

The water and general chemistry section analyzes an extremely wide range of sample types. The majority fall in the areas of water quality, effluent monitoring and general environmental monitoring. Close to 1,000 different chemical and elemental, analytical procedures are performed by this group.

Radiochemistry analyzes all sample types for naturally occurring, and the more common, man-made radionuclides. In addition, this laboratory measures radioactive tracers used in petroleum reservoir studies. The Slowpoke-2 reactor is used to measure uranium in solid and liquid samples and to analyze for other elements in samples that are difficult to process by conventional techniques. The Carbon-14 dating laboratory determines the age of archaeological and geological materials which contain carbon. This technique can be used to measure the age of specimens up to 30,000 years.

The chromatography section continues to analyze for an ever increasing number of organic compounds (herbicides, pesticides, hydrocarbons, aromatics, etc.) in water, soil, and other matrices. Measuring PCB's in electrical insulating oils is a major component of this work. Many towns and villages in the province have their water supplies monitored on a regular basis to check for the presence of toxic organic compounds and trace elements.

The Analytical Services Laboratory is able to respond quickly to many emergency situations (chemical spills, identification of hazardous substances, accidental environmental spills, etc.) and is continually expanding its capability in this area. This year, a new analytical system, plasma source-mass spectrometry, was installed. It is the third such installation in a commercial laboratory in Canada. Nearly all elements from lithium on up in the periodic table can be analyzed by this technique. Detection limits as low as 50 parts per trillion can be achieved for some elements. Because of its sensitivity and simultaneous, multi-element capability it is expected that this will become one of the most versatile analytical tools.

The laboratory has an ongoing program of methods improvement and new methods development. The staff of over 20 professionals and technicians are committed to excellence in service and ensuring that the laboratory maintains its position at the forefront of analytical technology.

Canadian Centre for Advanced Instrumentation

Innovative instrumentation design, development and service.

The Canadian Centre for Advanced Instrumentation (CCAI) Precision Instruments Group plays a part in the design, testing and production of all CCAI products. Here, Murray Peters assembles and tests a MINITUBE™ Air Sampling System (MASS) unit.

SRC acts as a parent company to the Canadian Centre for Advanced Instrumentation (CCAI), an internationally recognized resource centre devoted to solving problems in industry, education and government through the use of innovative instrumentation.

People familiar with CCAI know the success story of its MINITUBE™ Air Sampling System, developed under contract with the federal Department of National Defence (DND). The air sampling system traps, collects, and analyzes airborne contaminants in the form of gases, vapours, and aerosols. This year air sampling specialists from several NATO countries watched a successful field demonstration of the system at DND's Defence Research Establishment (DRES) in Suffield, Alberta.

CCAI handles a broad range of services for an equally broad range of clients. The year saw a number of highlights:

- an evaluation study of the automotive add-on devices for the "Lights On Saskatchewan" program completed for the Saskatchewan Government
- precipitation sampler and recorder developed for the Water Quality Branch of Environment Canada was field tested and resulted in a further contract
- a mold for toilet tank dispensers was developed for a local company
- a study on electrical demand cost estimates was delivered to a local real estate firm
- a control for crop spraying was produced for a local implement manufacturer
- instrument maintenance for a number of Saskatchewan companies was carried out along with a contract from Atomic Energy of Canada in Gentilly, Quebec to calibrate and service 20 radiation monitoring instruments
- sales of acid rain collectors, droplet generators, rotary fusion burners, water-level recorders and replacement rings for the rotary fusion burner continued
- an aerodynamic spray nozzle was engineered for the University of California
- a snow depth gauge, designed by Environment Canada, was evaluated
- a prototype smoke monitor was developed
- an electronic timer, with digital display, was developed to replace mechanical timers on water conditioners for a provincial company
- a study was conducted for a local company to determine the technical feasibility of sensors suggested for a golf swing analyzer
- third-party service contract, for the maintenance of scientific equipment, was secured from Pharmacia Canada Inc.
- patent application for a device developed by a local printer was appraised for technical uniqueness
- two droplet generators, designed by National Aeronautical Laboratories, were produced and sold

CCAI is partially funded by a contribution from the federal Department of Regional Industrial Expansion.

CCAI ADVISORY BOARD

Ralph Cheesman
Manager
Saskatchewan Mining Association, Regina

Rainer Anderson
Director, Program Operations
askatchewan Region
Regional Industrial Expansion, Saskatoon

Bill Whelan
Manager
Saskatchewan Division
Canadian Petroleum Assoc., Regina

Howard Tennant
Vice President, Research
University of Saskatchewan, Saskatoon

John Cross
President
Philom Bios Inc., Saskatoon

Bill Misskey
Associate Professor
Engineering Division
University of Regina, Regina

Larry Hanna
General Manager
Saskatoon Chemicals, Saskatoon

Bob Lawrence
Senior Vice President
Saskatchewan Power Corporation, Regina

Robert Lockwood
Dean
Agricultural Science & Resource Programs
Olds College
Olds, Alberta

Communications

SRC's Communications department provides support services to all programs and publishes six newsletters: *SRC News* (quarterly); *Inside SRC* (quarterly); *Technology Transfer* (quarterly); *Management Insights* (quarterly); *GeoScience Newsletter* (biannually); *Remote Sensing Newsletter* (quarterly), and the *Annual Report*. Also available are program fact sheets, brochures, and an overview of SRC entitled, *Saskatchewan Research Council*. The department arranges tours of SRC for interested groups and coordinates all trade show activities.

Contact Anna Marie Barabas for tours and newsletter requests - 933-7422.

The Saskatchewan Research Council
Year Ended March 31, 1986

Financial Statements

Auditor's Report

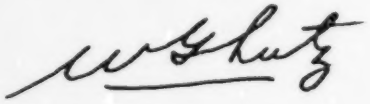
To the Members of the Legislative Assembly
Province of Saskatchewan

I have examined the balance sheet of the Saskatchewan Research Council as at March 31, 1986 and the statements of revenue, expenditure and accumulated surplus and changes in financial position for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Council as at March 31, 1986 and the results of its operations and the changes in its financial position for the year then ended in accordance with the disclosed basis of accounting applied, after giving retroactive effect to the change in accounting for sick leave benefits payable as explained in Note 9 to the financial statements, on a basis consistent with that of the preceding year.

Regina, Saskatchewan,
August 15, 1986.

W.G. Lutz, F.C.A.,
Provincial Auditor.



Statement 1

BALANCE SHEET

As At March 31

ASSETS	1986	1985
Current assets:		
Accounts receivable	$2,396,610	$1,963,073
Prepaid expenses	297,164	60,936
	2,693,774	2,024,009
Deferred charges (Note 6)	137,631	-
Fixed assets (Note 4)	2,704,599	2,116,642
Other assets	3,939	3,939
	$5,539,943	$4,144,590
LIABILITIES AND PROVINCE'S EQUITY		
Current liabilities:		
Cash, less outstanding cheques	$ 88,677	$ 312,179
Research grants payable	109,626	113,927
Accounts payable	973,404	1,502,319
Accountable advance (Note 8)	1,125,915	-
Employee deductions payable	308,982	174,971
Deferred revenue (Notes 5 and 6)	761,700	309,531
Vacation and benefits payable	250,446	165,588
	3,618,750	2,578,515
Non-current liabilities:		
Sick leave benefits payable (Note 9)	312,027	293,296
Deferred revenue (Note 5)	738,278	698,566
	4,669,055	3,570,377
Province's equity:		
Accumulated surplus (Statement 2)	870,888	574,213
	$5,539,943	$4,144,590

(See accompanying notes to the financial statements)

Statement 2

STATEMENT OF REVENUE, EXPENDITURE AND ACCUMULATED SURPLUS

Year ended March 31

	1986	1985
Revenue:		
Contracts (Note 5)	$ 8,997,530	$ 6,200,135
Provincial government grant		
— general purpose (Note 6)	4,316,410	4,431,300
— employment assistance programs (Note 6)	1,414,951	-
Interest	96,490	72,495
Other (Note 5)	228,754	155,091
	15,054,135	10,859,021
Expenditure:		
Salaries	7,587,244	6,108,089
Employee benefits	864,097	699,413
Supplies and technical services	2,564,339	1,886,254
Employment assistance programs (Note 6)	1,166,951	325,000
Depreciation	715,556	561,785
Travel and vehicle operations	331,452	286,472
Rent and utilities	774,698	385,882
Research grants	110,000	113,553
Other	643,123	487,525
	14,757,460	10,853,973
Excess of revenue over expenditure	296,675	5,048
Accumulated surplus, as previously reported	867,509	858,043
Adjustment due to change in accounting policy (Note 9)	(293,296)	(288,878)
Accumulated surplus, beginning of year, restated	574,213	569,165
Accumulated surplus, end of year — to Statement 1	$ 870,888	$ 574,213

(See accompanying notes to the financial statements)

Statement 3

STATEMENT OF CHANGES IN FINANCIAL POSITION

Year Ended March 31

	1986	1985
Cash provided by (used in):		
Operating Activities:		
Excess of revenue over expenditure	$ 296,675	$ 5,048
Add (deduct) items not affecting cash:		
Depreciation	715,556	561,785
Amortization of deferred revenue	(351,521)	(418,676)
(Gain) loss on disposal of fixed assets	(6,773)	14,281
Increase in sick leave benefits payable	18,730	4,418
	672,667	166,856
Changes in non-cash items		
Accounts receivable	(433,537)	35,760
Prepaid expenses	(236,228)	(20,062)
Deferred charges	(137,631)	-
Research grants payable	(4,301)	10,630
Accounts payable	(528,915)	901,906
Accountable advance	1,125,915	-
Employee deductions payable	134,011	3,997
Deferred revenue	843,402	902,431
Vacation and benefits payable	84,859	76,167
	847,575	1,910,829
	1,520,242	2,077,685
Investment Activities:		
Purchase of fixed assets	(1,303,740)	(1,336,534)
Proceeds from sale of fixed assets	7,000	11,442
	(1,296,740)	(1,325,092)
Increase in cash position	223,502	752,593
Cash position, beginning of year	(312,179)	(1,064,772)
Cash position, end of year	$ (88,677)	$ (312,179)

(See accompanying notes to the financial statements)

NOTES TO THE FINANCIAL STATEMENTS

1. Status of The Saskatchewan Research Council

The Saskatchewan Research Council was established pursuant to Section 3 of The Research Council Act for the purpose of research and investigation in the fields of the physical sciences, pure and applied, as they affect the economy of the Province of Saskatchewan. The Council is a body corporate which receives moneys appropriated by the Legislature for these purposes and is also empowered to conduct research under contract for others and to receive financial assistance pursuant to agreements with other similar agencies.

2. Summary of Accounting Policies

(a) Revenue Recognition

Grant revenue is recognized in the accounts as follows:

i) Moneys appropriated by the Legislature for the general purposes of The Research Council Act are recorded in the same period the moneys are paid from appropriated funds of the Legislature.

ii) Other grants received for specific purposes are included in revenue to the extent of related expenses incurred during the year. Grant receipts in excess of related expenses are reflected as deferred grant revenue.

Revenue from the majority of contract work is recognized on the percentage-of-completion method which recognizes revenue as a contract progresses. Unbilled revenues are accrued to the year end for these contracts, while pre-billed revenues received are classified as deferred revenue.

Revenue from analytical lab work, involving shorter term contracts without substantial outlays of direct costs, is recognized on a completed contract basis.

(b) Fixed Assets

The assets of the Council (see Note 7) are initially recorded at cost, including labour, material and overhead for self-constructed assets.

Depreciation is provided over the estimated useful lives of the assets on the following basis:

(i) Sum-of-the years'-digits method	
Buildings	20 years
Leasehold improvements	5 years
Equipment	10 years
(ii) Declining balance method	
Automotive	33⅓%

(c) Pension Costs

The Council participates with its employees in a defined benefit final average pension plan and, in accordance with recommendations of the Plan's actuary, contributions to the Pension Fund by the Council are made in amounts necessary to fund benefits accruing for current service and to fund past service benefits, if any, over reasonable time periods. The cost of funding the Pension Plan on the basis recommended by the actuary is reflected in these statements to the extent of contributions made to the Pension Fund in each year.

(d) Research Grants

Research grants awarded annually by the Council to aid in funding approved research projects are charged to expenditure in the year in which costs are incurred on the projects.

(e) Accrued Vacation Credits

The costs associated with vacation credits are recognized when the vacation entitlements are earned. The value of credits plus associated employee benefit costs earned to the year end but not taken are reflected as a liability.

(f) Sick Leave Benefits

The Council allows unused sick leave credits to accumulate over the term of employment for each employee and pays out 10% of the unused accumulated sick leave based on the wage rate in effect at the time of termination of employment. The costs associated with these sick leave benefits are recognized when benefits are earned and accumulated by employees at a rate of 10% of the unused accumulated value of credits earned.

3. Pension Plan - Actuarial Valuation

An actuarial valuation was performed as at December 31, 1983 on the Saskatchewan Research Council Employees' Pension Plan. The actuary stated that using the accrued benefit actuarial cost method, the present value of accumulated benefits resulting from services provided to the valuation date was $4,574,382. The actuary also stated that the value of Pension Fund assets was $4,889,526 based on averaged market values. The resulting net actuarial surplus is stated to be $315,144. The report also recommends that the employer contribute at least 95.9% of employee contributions to meet the cost of benefits to be earned for service after the valuation date.

The next actuarial valuation is required to be performed no later than as at December 31, 1986.

4. Fixed Assets

	1986			1985
	Cost	Accumulated Depreciation	Net Book Value	Net Book Value
Buildings	$ 756,860	$ 411,929	$ 344,931	$ 393,244
*Leasehold Improvements	445,512	433,552	11,960	22,486
*Equipment	5,403,298	3,106,640	2,296,658	1,639,610
Automotive	244,909	224,859	20,050	30,302
Land	31,000	-	31,000	31,000
	$6,881,579	**$4,176,980**	**$2,704,599**	**$2,116,642**

*See note 7 for details of Petroleum Division assets acquired for nominal consideration

5. Deferred Revenue

(a) Potash Corporation of Saskatchewan

The Council has deferred revenue of $305,642 from the Potash Corporation of Saskatchewan for prepaid rent of a pilot plant. The revenue is being reflected in the accounts by the sum-of-the-years'-digits method over the 10 year term of the agreement which commenced in the 1981-82 fiscal year. The current portion of this deferred revenue is $70,543 and is classified accordingly on the balance sheet while the amount included in other revenue in the current year is $75,286 (1985 - $80,028).

(b) Government of Canada

During the year the Council received $725,000 (1985 - $900,000) from the federal government under an agreement to jointly fund the costs of operating the Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) Centre. The portion of this amount attributable to capital costs of $301,818 (1985 - $600,300) is being amortized in the accounts by the sum-of-the-years'-digits method over a ten year period which corresponds to the depreciation period of the assets purchased under the terms of the agreement, which commenced in 1984-85 fiscal year. The current portion of the deferred revenue is $136,693 and is classified accordingly on the balance sheet while the amount of revenue included in contract revenue in the current year is $153,101 (1985 - $109,145).

The remaining $423,182 (1985 - $299,700) of the amount received in the current year relating to this agreement, attributable to operating costs, is also included in contract revenue. Under the terms of the agreement, the Government of Canada will contribute an additional $845,000 over the next four years.

6. Commitments

A grant of $1,880,000 was received from the Saskatchewan Employment Development Agency for the Council to administer and fund the Students in Industry and Graduates in Industry Programs. Funding for these programs totalling $325,000 was included in the provincial grant revenue appropriated for general purposes in 1985. These programs subsidize companies employing students and graduates hired under the programs. At March 31, 1986 there were outstanding commitments to various companies totalling $413,049. It is estimated that the cost of administering the program in 1986/87 will be $52,000. According to the accounting policy described in Note 2, $1,414,951 is reflected as grant revenue and $465,049 is included in deferred revenue.

During the year, the Council signed an agreement with The Advanced Technology Training Centre to fund CAD/CAM equipment purchases by the Centre as set out in the agreement. The Advanced Technology Training Centre is to provide the Council with computer services at a base level of system resource units over a four-year period commencing November 1, 1985. During 1985/86, the Council paid $183,507 to the Centre of which $137,631 is classified as deferred charges and will be amortized on a straight-line basis over the four-year period. At March 31, 1986 there is an outstanding funding commitment of $183,507.

7. Related Party Transactions

Related parties to the Council are Saskatchewan's Crown controlled departments, agencies and corporations. Transactions with these parties are recorded at normal market prices except for certain buidings built for The Saskatchewan Research Council's use by the Department of Supply and Services at no cost to the Council and except for certain operations of the Petroleum Division as described below.

In June, 1985, the Council established a Petroleum Division by assuming the operations of the Heavy Oil Lab, previously operated by the Saskatchewan Oil and Gas Corporation, for a nominal amount of one dollar. The acquisition includes equipment and leasehold improvements with an original purchase price of $2.9 million. The Petroleum Division conducts a substantial portion of its research with the Department of Energy and Mines. These transactions are recorded at normal market prices based on rates established in contractual agreements between the Council and the Department of Energy and Mines.

8. Accountable Advance

This advance was made by the Department of Energy and Mines to minimize any cash flow problems resulting from the transfer of the Heavy Oil Lab to the Council. Under the memorandum of understanding between the Department and the Council dated August 27, 1985, the Council agrees to utilize this advance exclusively for the Petroleum Division's lab activities relating to contracts with the Department. Also, one-half of all interest earned as determined by the above Memorandum of Understanding shall accrue to the Department. As at March 31, 1986, $11,596 of interest earned was credited to the advance account. The Council will begin to reduce the advance by offsetting it with current charges applicable to contracts with the Department once it receives written directions from the Department to do so.

9. Change in Accounting Policy

During the year the Council changed its accounting policy with respect to the accounting for sick leave benefits. Previously, the cost of sick leave benefits was recognized when benefits were paid out upon termination. In the current year, the Council adopted a policy of recognizing this cost when the sick leave benefits are earned and accumulated by employees as described in note 2(f). The retroactive application of this change in policy has resulted in a decrease in accumulated surplus at the beginning of the year of $293,296. Of this amount $4,418 relates to the 1984-85 fiscal year and $288,878 relates to years prior to 1984-85.

10. Comparative Figures

Certain comparative figures have been reclassified in order to conform with the current year's presentation.

GRANTS-IN-AID 1985-1986

Since its creation in 1947, the Saskatchewan Research Council has provided grants to applicants in Saskatchewan universities for applied research in the sciences. This year eight ongoing projects were allocated $60,000, and five new proposals received $47,000. Of the 13 supported projects, four at the University of Regina received $30,000 and nine at the University of Saskatchewan received $77,000.

The following projects were supported under the Grants-In-Aid program:

UNIVERSITY OF SASKATCHEWAN - 1985-1986

Department of Applied Microbiology and Food Science
A.K. Sumner
Effect of Immaturity and Harvesting Method on Cereal Crop Quality

Department of Chemical Engineering
N.N. Bakhshi
Pyrolytic Studies of Saskatchewan Heavy Oils with Additives

Department of Chemistry
R.J. Woods
Neutron Activation Analysis of Trace Elements in Soil

Department of Civil Engineering
M.D. Haug
Evaluation of Secondary Permeability in Sand-Bentonite Liners Used to Contain Uranium Wastes

Department of Civil Engineering
E.K. Sauer
Hydrogeology of Saline Basins

Department of Crop Science and Plant Ecology
R. Ashford
Efficacy of Herbicides as Affected by Application

Department of Geological Sciences
W.G.E. Caldwell
Geochemical Studies of Cretaceous Marine Cyclothemic Sequences in Saskatchewan

Department of Geological Sciences
M. Reeves
Evaluation of Secondary Permeability in Sand-Bentonite Liners Used to Contain Uranium Wastes

Department of Mathematics
M.J. Miketinac
Airflow Through Corn Mixed with Fines

UNIVERSITY OF REGINA - 1985-1986

Department of Biology
D.R. Cullimore
Factors Influencing the Microbiological Loading of the Regina Water Distribution System Related to the Regina Aquifer

Department of Energy Research Unit
D.G. Vandenberghe
Energy Efficient Masonry Blocks

Department of Engineering
J.C. Mozel
CAD/CAM Consortium

Department of Geology
B.R. Watters
Geochemistry of Intrusive Rock Units of the Central La Ronge Domain

SCHOLARSHIPS 1985-1986

The Saskatchewan government offers graduate research scholarships, tenable at either the University of Saskatchewan or the University of Regina. The purposes of the awards are to assist graduate students to prepare for careers in scientific and industrial research, and to create interest in the exploitation of Saskatchewan's resources and in techniques that will advance the development of the province. SRC conducts the selection of the candidates.

Awards valued at $9,900 for the year beginning May 1, 1985 were made to:

K.M. Bell
Department of Geography
University of Regina

J.W. Pomeroy
Department of Agricultural Engineering
University of Saskatchewan

S. Rosa
Department of Mechanical Engineering
University of Saskatchewan

Board of Directors Saskatchewan Research Council, 1986

Gordon C. Birney
Chairman, SRC
Partner, Birney & Smith
Chartered Accountants
Saskatoon

Alex J.Y. Guy
Vice-Chairman, SRC
Deputy Minister
Saskatchewan Science and Technology, Regina

Jim Hutch
Secretary, SRC
President, SRC

Gordon Currie
Legislative Secretary
Advanced Education and Manpower, Regina

Leon Katz
Saskatoon

Howard E. Tennant
Dean, College of Graduate Studies and Research
Associate Vice-President (Research)
University of Saskatchewan, Saskatoon

Hugo S. Maliepaard
Director, Research, Policy and Planning, Saskatchewan Department of Environment, Regina

W.L. (Bill) Whelan
Manager, Saskatchewan Division, Canadian Petroleum Association, Regina

Peter Nikiforuk
Dean, College of Engineering
University of Saskatchewan, Saskatoon

Cam Blachford
Dean of Graduate Studies and Research
University of Regina

John W.T. Spinks
President Emeritus
University of Saskatchewan, Saskatoon

Marcel de la Gorgendiere
Partner, de la Gorgendiere, Pederson, Pinch and Turnbull, Saskatoon

Alex Curran
Saskatoon

Oscar Hanson
Vice-President, Customer & Corporate Services
Saskatchewan Power Corporation, Regina

Adeleine Morris
President
Morris Rod Weeder, Yorkton

John Nightingale
President and Chief Executive Officer
Key Lake Mining, Saskatoon

Carol Teichrob
Moonvale Farms, Saskatchewan

Warren Steck
Director, National Research Council
Plant Biotechnology Institute, Saskatoon

Staff of the Saskatchewan Research Council, 1986

President's Office

President:
Jim Hutch, B.Sc., P.Eng.
Assistant to President:
M. Sarich, B.A.
Secretarial Staff:
B. Gilroy
L. Janzen
Special Assignment:
J. Bergsteinsson, B.A.

Research and Development Branch

Vice President:
W.H.W. Husband, Ph.D., M.B.A., P.Eng.

Resources Division

Director:
R.G. Arnold, Ph.D.

Mineral Resources Program
Coordinator:
M. Mellinger, Doc. Spc., M.A.Sc.
Staff:
J. Dyck, Ph.D., P.Eng.
C. McKenzie, M.B.A., P.Eng.
D. Quirt, M.A.Sc.
J.W.J. Smith, B.Sc.
J. Bilewski
S. Luc
R. Blum, M.Sc., B.E.

Resource Processing Program
Manager:
J.W. Spyker, M.Sc., P.Eng.
Staff:
J. Hudson, M.A.
J. Lehtinen, B.Sc.
R. Gillies, M.Sc., P.Eng.
D. Haas, M.Sc., P.Eng.
M. Small, Chem. Tech.
J. Jones, I.Tech.
P. Schergevitch
J. Lychak
R. McKnight

Biomass Resources Program
Manager:
E. Coxworth, Ph.D.
Staff:
W. Craig, Ph.D.
J. Kernan, M.Sc.
A. Rutherford, M.Sc.
K. Sosulski, Ph.D.
M. Gimby, Dip. Agr.
P. Kullman
E. Swerhone
A. Mair

Sedimentary Resources Program
Coordinator:
B.T. Schreiner, M.Sc., P.Eng.
Staff:
H. Maathuis, M.Sc.
G. van der Kamp, Ph.D.
W.C. Ross, B.Sc.
M. Simpson, B.A.
J. Campbell, B.Sc.
E. Jaworski, R.R. Tech.
T. Warkentin, Chem. Tech.

D. Zlipko, Water Sci. Tech.
J. Stoutenburg, B.Sc.
M. Millard, B.Sc.
B. Campbell, B.Sc.

Buildings and Energy Technology Program
Manager:
D. Eyre, B.Sc.
Staff:
M. Sulatisky, M.Sc.
D. Jennings
J. Flynn
S. Niyazi

Geochemical Services Program
Manager:
A. Holsten, B.Sc.
Staff:
P. Archibald
B. Bell
S. Cutts
B. Gartner
A. Jackson
C. McClelland
D. Friesen

Environment Division

Director:
J. Maybank, Ph.D.

Aquatic Biology Program
Manager:
S. Swanson, Ph.D.
Staff:
G. Lakshman, M.Sc.
P. Tones, Ph.D.
K. Bindle
B. Paquin, R.R. Tech.
D. Richert, R.R. Tech.
C. Rickard, R.R. Tech.

Terrestrial Ecology Program
Manager:
Z. Abouguendia, M.Sc.
Staff:
J. Polson, B.Sc.
B. Godwin, B.S.A.
L. Baschak, B.S.A.

Archaeology Program
Manager:
J. Wilson, M.A.
Staff:
D. Meyer, Ph.D.
J. Finnigan, M.A.
O. Klimko, M.A.
C. Beaulieu, B.A.
B. Ferris, B.A.
P. McKeand, B.A.
D. Russell, B.A.

Surface Hydrology Program
Manager:
J. Whiting, M.Sc.
Staff:
R. Bouvier
R. MacPherson
N. Nicolichuk, Civ. Eng. Tech.
B.J. Smith

Atmospheric Processes Program
Manager:
S. Shewchuk, Ph.D.
Staff:
K. Yoshida, Ph.D.
K. Wallace, B.Sc.
E. Wheaton, M.Sc.
R. Jahren, R.R. Tech.
R. Begrand, B.Sc.
J. Ross

Petroleum Division

Director:
J. Hutchinson, M.Sc.
Senior Secretary:
E. Goodin

Petroleum Research Unit
Manager:
R. Ranganathan, Ph.D.
Staff:
S. Huang, Ph.D.
B. Kristoff, B.Sc.
F. Mourits, Ph.D.
N. Freitag, Ph.D.
E. Pappas, B.Sc.
D. Soveran, B.Sc.
B. Verkoczy, Ph.D.
I. Kitamura
K. Knorr, Mech. Eng. Tech.
L. Kurucz, Chem. Tech.
E. Ogu, M.Sc.
J. Scoular, B.Sc.
P. de Wit, Chem. Tech.
R. Exelby, Mech. Eng. Tech.
C. Jackson
K. Kovacs, Chem. Eng. Tech.
N. Shatilla, Chem. Tech.
N. Bowden, B.Sc.
D. Hymers

Analytical Services Unit
Manager:
M. Myers, B.A.
Staff:
E. Chung, B.Sc.
M. Cecchetto, Chem. Eng. Tech.
G. Perron, Bio. Sc. Tech.
N. Gaveronski
V. Barnabe

Research Planning and Special Projects
Manager:
K. Jha, Ph.D.
Administration:
R. Hearn, Dip. Bus.
J. Giesinger

Technical Information Services
D. Sinclair
E. Exelby

Technology Transfer Branch

Vice President:
E.H. Wiens, M.B.A., M.Sc., P.Eng.
Assistant:
J. Poon, B.Comm.

Product and Process Development Division
Director:
G. Pierce, M.Sc., P.Eng.
Staff:
T. Kaminski, Ph.D.
D. Grier, B.E., P.Eng.
A. Malinoski, B.Sc., P.Eng.
D. Florizone, Mech. Eng. Tecn.
R. Reich, Arch. Tech.
A. Grimsen
K. Holdstock
C. Jahren, B.A.
H. Wooff, CAD/CAM Eng. Tech.
P. Dumontier
N. Osborne

Field Services Division
Director:
D. Glossop, P.Eng.
Staff:
R. Levesque, B.Sc., P.Eng.
C. Kuchinka, B.E., P.Eng.
B. Zuk, B.A., B.Sc., P.Eng.
G. Kocdag, B.Sc.
R. Wong, B.E., P.Eng.
F. Popoff
J. Sher, B.Sc., P.Eng.
L. Sopher, B.Ed.

Innovation Division
Director:
J. Spankie, B.Sc., P.Eng.

Business Development Branch

Vice President:
R. Maithel, M.Sc., P.Eng.

Management Consulting Division
B. Ward, B.Sc.
L. Smith, B.Comm.

Administration and Finance Branch

Vice President:
G. MacKay, B.A., C.R.M.
Safety Officer:
J. Meginbir, B.A.

Analytical Services Program
Manager:
G. Smithson, Ph.D., P.Eng.
Staff:
W. Yuen, Ph.D.
M. Fahri, B.Sc.
B. Stanek, B.Sc.
S. Punani, M.Sc.
L. MacDonald
F. Oro, M.Sc.
L. Ty, B.Sc.
J. Wittenberg
R. Brule
D. Chorney, Chem. Tech.
L. Didur
G. Drader, Chem. Tech.
S. Barnes
I. Khosla
J. Ma, B.Sc.
S. Magon
P. Moser, Chem. Tech.
V. Evans
L. Turple, B.Sc.
G. Woytowich
J. Zimmer, Chem. Tech.
L. Chrusch
W. Russell

Shops and Facilities Services
Manager:
K. Owens
Staff:
B. Marshall
D. McEwan
J. Wright
T. Voth
I. Coleman
M. Timmins

Graphics Services
Manager:
B. Taylor, C.C.
Staff:
C. Sardinha, C.C.
B. McIntosh, C.C.
E. Perkins, C.E.T.
H.G. Piek
J. Mamer

Information Centre
Manager:
M. Samms, Lib. Tech.
Staff:
C. Kelly, M.A.
M.P. Will, B.Ed.
I. Shepherd
K. Sthankiya, Lib. Tech.
R. Middleton

Departmental Services
Manager:
E. Weegar
Staff:
D. Collins
D. Diduck
G. Calderon
B. Hoyseth
D. Schergevitch
B. Duerksen
B. Thomson

Financial Services
Controller:
R.J. McGrath, M.B.A., C.M.A.
Staff:
H.A. MacEwan
L. Jones
W. Rielkoff
M. Lutz
M. Makohoniuk
K. Kosteniuk
M. Millhouse

Human Resources
Manager:
J. Sanderson
Personnel Assistants:
B. Clark
M. Limet

Canadian Centre for Advanced Instrumentation Branch

Managing Director:
D. Barnett

Electronics Group
Manager:
T. Locke, M.Sc., P.Eng.
Staff:
K. Young, B.Sc., Elec. Tech.
R. Matieshin
R. Pinchbeck
C. Hinz, B.E.

Precision Instrument Group
Manager:
O. Olm
Staff:
W. Ostwald
M. Peters
B. Symak
G. van Dongen

Communications Department
Manager:
K. Lawrence, B.A.
Staff:
B. Erickson, B.A.
A.M. Barabas